U.S. Environmental Protection Agency

National Center for Environmental Assessment

Office of Research and Development

Exposure Factors Handbook






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About the Handbook

The National Center for Environmental Assessment has prepared this handbook to address factors commonly used in exposure assessments. This handbook was first published in 1989 in response to requests from many EPA Program and Regional offices for additional guidance on how to select values for exposure assessments.

This document provides a summary of the available data on consumption of drinking water; consumption of fruits, vegetables, beef, dairy products, and fish; soil ingestion; inhalation rates; skin surface area; soil adherence; lifetime; activity patterns; body weight; consumer product use; and the reference residence.

The handbook is equipped with a number of tools meant to help the user navigate through the Exposure Factors Handbook. The following is a description of these tools.

Some of the links that appear throughout the document will transport the user to another portion of the handbook. An indication that the user has encountered a hypertext link is that the hand in the Adobe Acrobat Reader will change to a hand with a pointing finger or an arrow.

Arrow buttons at the top of the screen are part of the Adobe Acrobat Reader program and will allow the user to move through files which have been opened. These arrows include:


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This button will magnify the view on the screen. Push the button, move the mouse to the portion of the screen the user wants magnified, and click the left mouse button.

The user will need to use the last view button (the double arrow pointing to the left above) to maneuver from the tables to the text of the Exposure Factors Handbook. A more convenient way of maneuvering between the tables and text is being explored.

At the left of each page in the Exposure Factors Handbook, the user will find a Bookmarks Panel containing bookmarks to jump to any other chapter, table, appendix, or figure in the handbook.

PREFACE

The National Center for Environmental Assessment (NCEA) of EPA's Office of Research and Development (ORD) has prepared this handbook to address factors commonly used in exposure assessments. This handbook was first published in 1989 in response to requests from many EPA Program and Regional offices for additional guidance on how to select values for exposure factors.

Several events sparked the efforts to revise the Exposure Factors Handbook. First, since its publication in 1989, new data have become available. Second, the Risk Assessment Council issued a memorandum titled, "Guidance on Risk Characterization for Risk Managers and Risk Assessors," dated February 26, 1992, which emphasized the use of multiple descriptors of risk (i.e., measures of central tendency such as average or mean, or high end), and characterization of individual risk, population risk, important subpopulations. A new document was issued titled "Guidance for Risk Characterization," dated February 1995. This document is an update of the guidance issued with the 1992 policy. Third, EPA published the revised Guidelines for Exposure Assessment in 1992.

As part of the efforts to revise the handbook, the EPA Risk Assessment Forum sponsored a two-day peer involvement workshop which was conducted during the summer of 1993. The workshop was attended by 57 scientists from academia, consulting firms, private industry, the States, and other Federal agencies. The purpose of the workshop was to identify new data sources, to discuss adequacy of the data and the feasibility of developing statistical distributions and to establish priorities.

As a result of the peer involvement workshop, three new chapters were added to the handbook. These chapters are: Consumer Product Use, Residential Building Characteristics, and Intake of Grains. This document also provides a summary of the

available data on consumption of drinking water; consumption of fruits, vegetables, beef, dairy products, grain products, and fish; breast milk intake; soil ingestion; inhalation rates; skin surface area; soil adherence; lifetime; activity patterns; and body weight.

A new draft handbook that incorporated comments from the 1993 workshop was published for peer review in June 1995. A peer review workshop was held in July 1995 to discuss comments on the draft handbook. A new draft of the handbook that addressed comments from the 1995 peer review workshop was submitted to the Science Advisory Board (SAB) for review in August 1996. An SAB workshop meeting was held December 19-20, 1996, to discuss the comments of the SAB reviewers. Comments from the SAB review have been incorporated into the current handbook.

FOREWORD

The National Center for Environmental Assessment (NCEA) of EPA's Office of Research and Development (ORD) has five main functions: (1) providing risk assessment research, methods, and guidelines; (2) performing health and ecological assessments; (3) developing, maintaining, and transferring risk assessment information and training; (4) helping ORD set research priorities; and (5) developing and maintaining resource support systems for NCEA. The activities under each of these functions are supported by and respond to the needs of the various program offices. In relation to the first function, NCEA sponsors projects aimed at developing or refining techniques used in exposure assessments.

This handbook was first published in 1989 to provide statistical data on the various factors used in assessing exposure. This revised version of the handbook provides the up-to-date data on these exposure factors. The recommended values are based solely on our interpretations of the available data. In many situations different values may be appropriate to use in consideration of policy, precedent or other factors.

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The National Center for Environmental Assessment (NCEA), Office of Research and Development was responsible for the preparation of this handbook. The original document was prepared by Versar Inc. under EPA Contract No. 68-02-4254, Work Assignment No. 189. John Schaum, of NCEA-Washington Office, served as the EPA Work Assignment Manager, providing overall direction and coordination of the production effort as well as technical assistance and guidance. Revisions, updates, and additional preparation were provided by Versar Inc. under Contract Numbers 68-D0-0101, 68-D3-0013, and 68-D5-0051. Russell Kinerson and Greg Kew have served as EPA Work Assignment Managers during previous efforts of the update process. Jackie Moya served as Work Assignment Manager for the current updated version, providing overall direction, technical assistance, and serving as contributing author.

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The EPA Office of Water made an important contribution by conducting an analysis of the USDA Continuing Survey of Food Intakes by Individual (CSFII) data. They provided fish intake rates for the general population. The analysis was conducted under the direction of Helen Jacobs from the Office of Water.

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion					
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion	Drinking Water Intake Rate				
	Fruit and Vegetable Intake Rate				
	Meat and Dairy Intake Rate				
	Homegrown Foods				
	Breast milk Intake Rate				
	Fish and Shellfish Intake Rate				
	Soil Intake Rate				
	Grain Intake				
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion	Drinking Water Intake Rate	Adults Children Pregnant Women High Activity	I	3	3.6/3-35
	Fruit and Vegetable Intake Rate				
	Meat and Dairy Intake Rate				
	Homegrown Foods				
	Breast milk Intake Rate				
	Fish and Shellfish Intake Rate				
	Soil Intake Rate				
	Grain Intake				
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion	Drinking Water Intake Rate				
	Fruit and Vegetable Intake Rate	Various Demographic Groups — Age, Region, Season, Urbanization, Race	II	9	9.3/9-30
	Meat and Dairy Intake Rate				
	Homegrown Foods				
	Breast milk Intake Rate				
	Fish and Shellfish Intake Rate				
	Soil Intake Rate				
	Grain Intake				
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion	Drinking Water Intake Rate				
	Fruit and Vegetable Intake Rate				
	Meat and Dairy Intake Rate	Various Demographic Groups — Age, Region, Season, Urbanization, Race	II	11	11.4/11-31
	Homegrown Foods				
	Breast milk Intake Rate				
	Fish and Shellfish Intake Rate				
	Soil Intake Rate				
	Grain Intake				
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion	Drinking Water Intake Rate	Various Demographic Groups — Age, Region, Season, Urbanization, Race	II	13	13.5/13-72
	Fruit and Vegetable Intake Rate				
	Meat and Dairy Intake Rate				
	Homegrown Foods				
	Breast milk Intake Rate				
	Fish and Shellfish Intake Rate				
	Soil Intake Rate				
	Grain Intake				
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion	Drinking Water Intake Rate				
	Fruit and Vegetable Intake Rate				
	Meat and Dairy Intake Rate				
	Homegrown Foods				
	Breast milk Intake Rate	Nursing Infants	II	14	14.6/14-14
	Fish and Shellfish Intake Rate				
	Soil Intake Rate				
	Grain Intake				
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion	Drinking Water Intake Rate				
	Fruit and Vegetable Intake Rate				
	Meat and Dairy Intake Rate				
	Homegrown Foods				
	Breast milk Intake Rate				
	Fish and Shellfish Intake Rate	General Population	II	10	10.10.1/10-87
		Freshwater Recreational	II	10	10.10.3/10-89
		Marine Recreational	II	10	10.10.2/10-88
		Subsistence	II	10	10.10.4/10-90
	Soil Intake Rate				
	Grain Intake				
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion	Drinking Water Intake Rate				
	Fruit and Vegetable Intake Rate				
	Meat and Dairy Intake Rate				
	Homegrown Foods				
	Breast milk Intake Rate				
	Fish and Shellfish Intake Rate				
	Soil Intake Rate	Typical Children Adults Pica Children Various Demographic Groups — Age, Region, Season, Urbanization, Race	I	4	4.7/4-21
	Grain Intake				
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion	Drinking Water Intake Rate				
	Fruit and Vegetable Intake Rate				
	Meat and Dairy Intake Rate				
	Homegrown Foods				
	Breast milk Intake Rate				
	Fish and Shellfish Intake Rate				
	Soil Intake Rate	Typical Children Adults Pica Children Various Demographic Groups — Age, Region, Season, Urbanization, Race	II	12	12.3/12-24
	Grain Intake				
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion					
Inhalation	Inhalation Rate	Adults Children High Activity	I	5.	5.2.4/5-23
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS/ RATINGS TABLE PAGE NOS.
Ingestion					
Inhalation					
Dermal	Skin Surface Area	Adults Children	I	6.	6-8/6-25
	Soil Adherence	General Populationn	I	6.	6-8/6-27
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion					
Inhalation					
Dermal					
(All Routes) Human Characteristics	Body Weight				
	Lifetime				
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion					
Inhalation					
Dermal					
(All Routes) Human Characteristics	Body Weight	Adults Children	I	7	7.3/7-12
	Lifetime				
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion					
Inhalation					
Dermal					
(All Routes) Human Characteristics	Body Weight Lifetime	Adults Children	I	8	8.2/8-3
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion					
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors	Activity Patterns	Adults Children	III	15	15.4.1/15-172
	Occupational Mobility	Adults	III	15	15.4.2/15-173
	Population Mobility	Adults Children	III	15	15.4.3/15-175
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion					
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use	Frequency of Use Amount Used	Adults Adults	III	16	16.4
(All Routes) Residential Building Characteristics					

Figure 1-2. Road Map to Exposure Factor Recommendations

EXPOSURE ROUTE	EXPOSURE FACTOR	POPULATION	VOLUME	CHAPTER	RECOMMENDATIONS SECTION / RATINGS TABLE
Ingestion					
Inhalation					
Dermal					
(All Routes) Human Characteristics					
(All Routes) Activity Factors					
(All Routes) Consumer Product Use					
(All Routes) Residential Building Characteristics	Water Use Air Exchange Rates House Volumes Building Characteristics	General Population	III	17	17.6/17-32, 17-33

GLOSSARY

Absorption fraction (percent absorbed) - The relative amount of a substance that penetrates through a barrier into the body, reported as a unitless fraction.

Accuracy - The measure of the correctness of data, as given by the difference between the measured value and the true or standard value.

Activity pattern (time use) data - Information on activities in which various individuals engage, length of time spent performing various activities, locations in which individuals spend time and length of time spent by individuals within those various environments.

Air exchange rate - Rate of air leakage through windows, doorways, intakes and exhausts, and "adventitious openings" (i.e., cracks and seams) that combine to form the leakage configuration of the building envelope plus natural and mechanical ventilation.

Ambient - The conditions surrounding a person, sampling location, etc.

Analytical uncertainty propagation - Examines how uncertainty in individual parameters affects the overall uncertainty of the exposure assessment. The uncertainties associated with various parameters may propagate through a model very differently, even if they have approximately the same uncertainty. Since uncertainty propagation is a function of both the data and the model structure, this procedure evaluates both input variances and model sensitivity.

As consumed intake rates - Intake rates that are based on the weight of the food in the form that it is consumed.

Average daily dose - Dose rate averaged over a pathway-specific period of exposure expressed as a daily dose on a per-unit-body-weight basis. The ADD is used for exposure to chemicals with non-carcinogenic non-chronic effects. The ADD is usually expressed in terms of mg/kg-day or other mass/mass-time units.

Best Tracer Method (BTM) - Method for estimating soil ingestion that allows for the selection of the most recoverable tracer for a particular subject or group of subjects. Selection of the best tracer is made on the basis of the food/soil (F/S) ratio.

Boneless equivalent - Weights of meat (pork, veal, beef) and poultry, excluding all bones, but including separable fat sold on retail cuts of red meat.

Carcass weight - Weight of the chilled hanging carcass, which includes the kidney and attached internal fat (kidney, pelvic, and heart fat), excludes the skin, head, feet, and unattached internal organs. The pork carcass weight includes the skin and feet but excludes the kidney and attached internal fat.

Chronic intake - The long term period over which a substance crosses the outer boundary of an organism without passing an absorption barrier.

Comparability - The ability to describe likenesses and differences in the quality and relevance of two or more data sets.

Consumer-only intake rate - The average quantity of food consumed per person in a population composed only of individuals who ate the food item of interest during a specified period.

Contaminant concentration - Contaminant concentration is the concentration of the contaminant in the medium (air, food, soil, etc.) contacting the body and has units of mass/volume or mass/mass.

Creel Census - Approach used by fishery managers to obtain harvest data collected onsite from single anglers or from larger-scale commercial type operations.

Deposition - The removal of airborne substances to available surfaces that occurs as a result of gravitational settling and diffusion, as well as electrophoresis and thermophoresis.

Diary study - Survey in which individuals are asked to record food intake, activities, or other factors in a diary which is later used to evaluate exposure factors associated with specific populations.

Distribution - A set of values derived from a specific population or set of measurements that represents the range and array of data for the factor being studied.

Dose - The amount of a substance available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism. The potential dose is the amount ingested, inhaled, or applied to the skin. The applied dose is the amount of a substance presented to an absorption barrier and available for absorption (although not necessarily having yet crossed the outer boundary of the organism). The absorbed dose is the amount crossing a specific absorption barrier (e.g., the exchange boundaries of skin, lung, and digestive tract) through uptake processes. Internal dose is a more general term denoting the amount absorbed without respect to specific absorption barriers or exchange boundaries. The amount of a chemical available for interaction by any particular organ or cell is termed the delivered dose for that organ or cell.

Dose-response relationship - The resulting biological responses in an organ or organism expressed as a function of a series of doses.

Dressed weight - The portion of the harvest brought into kitchens for use, including bones for particular species.

Dry weight intake rates - Intake rates that are based on the weight of the food consumed after the moisture content has been removed.

Employer tenure - The length of time a worker has been with the same employer.

Exposed foods - Those foods that are grown above ground and are likely to be contaminated by pollutants deposited on surfaces that are eaten.

Exposure duration - Total time an individual is exposed to the chemical being evaluated.

Exposure Assessment - The determination or estimation (qualitative or quantitative) of the magnitude, frequency, or duration, and route or exposure.

Exposure concentration - The concentration of a chemical in its transport or carrier medium at the point of contact.

Exposure pathway - The physical course a chemical takes from the source to the organism exposed.

Exposure route - The way a chemical pollutant enters an organism after contact, e.g., by ingestion, inhalation, or dermal absorption.

Exposure scenario - A set of facts, assumptions, and interferences about how exposure takes place that aids the exposure assessor in evaluating estimating, or quantifying exposures.

Exposure - Contact of a chemical, physical, or biological agent with the outer boundary of an organism. Exposure is quantified as the concentration of the agent in the medium in contact integrated over the time duration of the contact.

Exposure duration - Length of time over which contact with the contaminant lasts.

General population - The total of individuals inhabiting an area or making up a whole group.

Geometric mean - The nth root of the product of n values.

Homegrown/home produced foods - Fruits and vegetables produced by home gardeners, meat and dairy products derived form consumer-raised livestock, game meat, and home caught fish.

Inhaled dose - The amount of an inhaled substance that is available for interaction with metabolic processes or biologically significant receptors after crossing the outer boundary of an organism.

Insensible water loss - Evaporative water losses that occur during breastfeeding. Corrections are made to account for insensible water loss when estimating breast milk intake using the test weighing method.

Intake - The process by which a substance crosses the outer boundary of an organism without passing an absorption barrier (e.g., through ingestion or inhalation).

Intake rate - Rate of inhalation, ingestion, and dermal contact depending on the route of exposure. For ingestion, the intake rate is simply the amount of food containing the contaminant of interest that an individual ingests during some specific time period (units of mass/time). For inhalation, the intake rate is the rate at which contaminated air is inhaled. Factors that affect dermal exposure are the amount of material that comes into contact with the skin, and the rate at which the contaminant is absorbed.

Internal dose - The amount of a substance penetrating across absorption barriers (the exchange boundaries) of an organism, via either physical or biological processes (synonymous with absorbed dose).

Interzonal airflows - Transport of air through doorways, ductwork, and service chaseways that interconnect rooms or zones within a building.

Lifetime average daily dose - Dose rate averaged over a lifetime. The LADD is used for compounds with carcinogenic or chronic effects. The LADD is usually expressed in terms of mg/kg-day or other mass/mass-time units.

Limiting Tracer Method (LTM) - Method for evaluating soil ingestion that assumes that the maximum amount of soil ingested corresponds with the lowest estimate from various tracer elements.

Local circulation - Convective and adjective air circulation and mixing within a room or within a zone.

Mass-balance/tracer techniques - Method for evaluating soil intake that accounts for both inputs and outputs of tracer elements. Tracers in soil, food, medicine and other ingested items as well as in feces and urine are accounted for.

Median value - The value in a measurement data set such that half the measured values are greater and half are less.

Microenvironment - The combination of activities and locations that yield potential exposure.

Moisture content - The portion of foods made up by water. The percent water is needed for converting food intake rates and residue concentrations between whole weight and dry weight values.

Monte Carlo technique - A repeated random sampling from the distribution of values for each of the parameters in a generic (exposure or dose) equation to derive an estimate of the distribution of (exposures or doses in) the population.

Occupational mobility - An indicator of the frequency at which workers change from one occupation to another.

Occupational tenure - The cumulative number of years a person worked in his or her current occupation, regardless of number of employers, interruptions in employment, or time spent in other occupations.

Pathway - The physical course a chemical or pollutant takes from the source to the organism exposed.

Per capita intake rate - The average quantity of food consumed per person in a population composed of both individuals who ate the food during a specified time period and those that did not.

Pica - Deliberate ingestion of non-nutritive substances such as soil.

Population mobility - An indicator of the frequency at which individuals move from one residential location to another.

Potential dose - The amount of a chemical contained in material ingested, air breathed, or bulk material applied to the skin.

Precision - A measure of the reproducibility of a measured value under a given set of circumstances.

Preparation losses - Net cooking losses, which include dripping and volatile losses, post cooking losses, which involve losses from cutting, bones, excess fat, scraps and juices, and other preparation losses which include losses from paring or coring.

Probabilistic uncertainty analysis - Technique that assigns a probability density function to each input parameter, then randomly selects values from each of the distributions and inserts them into the exposure equation. Repeated calculations produce a distribution of predicted values, reflecting the combined impact of variability in each input to the calculation. Monte Carlo is a common type of probabilistic Uncertainty analysis.

Protected foods - Those foods that have outer protective coatings that are typically removed before consumption.

Random samples - Samples selected from a statistical population such that each sample has an equal probability of being selected.

Range - The difference between the largest and smallest values in a measurement data set.

Recreational/sport fishermen - Individuals who catch fish as part of a sporting or recreational activity and not for the purpose of providing a primary source of food for themselves or for their families.

Representativeness - The degree to which a sample is, or samples are, characteristic of the whole medium, exposure, or dose for which the samples are being used to make inferences.

Residential volume - The volume (m^3) of the structure in which an individual resides and may be exposed to airborne contaminants.

Residential occupancy period - The time (years) between a person moving into a residence and the time the person moves out or dies.

Resource utilization - For any quantity Y that is consumed by individuals in a population, the percentiles of the "resource utilization distribution" of Y can be formally defined as follows: Y_p (R) is the pth percentile of the resource utilization distribution if p percent of the overall consumption of Y in the population is done by individuals with consumption below Y_p (R) and 100-p percent is done by individuals with consumption above Y_p(R).

Retail weight equivalent - Weight of food as sold through retail foodstores; therefore, conversion factors are used to correct carcass weight to retail weight to account for trimming, shrinkage, or loss of meat and chicken at retail outlets.

Route - The way a chemical or pollutant enters an organism after contact, e.g., by ingestion, inhalation, or dermal absorption.

Sample - A small part of something designed to show the nature or quality of the whole. Exposure-related measurements are usually samples of environmental or ambient media, exposures of a small subset of a population for a short time, or biological samples, all for the purpose of inferring the nature and quality of parameters important to evaluating exposure.

Screening-level assessments - Typically examine exposures that would fall on or beyond the high end of the expected exposure distribution.

Sensitivity analysis - Process of changing one variable while leaving the others constant to determine its effect on the output. This procedure fixes each uncertain quantity at its credible lower and upper bounds (holding all others at their nominal values, such as medians) and computes the results of each combination of values. The results help to identify the variables that have the greatest effect on exposure estimates and help focus further information-gathering efforts.

Serving sizes - The quantities of individual foods consumed per eating occasion. These estimates may be useful for assessing acute exposures.

Soil adherence - The quantity of soil that adheres to the skin and from which chemical contaminants are available for uptake at the skin surface.

Subsistence fishermen - Individuals who consume fresh caught fish as a major source of food.

Test weighing - A method for estimating breast milk intake over a 24-hour period in which the infant is weighed before and after each feeding without changing its clothing. The sum of the difference between the measured weights over the 24-hour period is assumed to be equivalent to the amount of breast milk consumed daily.

Total tapwater - Water consumed directly from the tap as a beverage or used in the preparation of foods and beverages (i.e., coffee, tea, frozen juices, soups, etc.).

Total fluid intake - Consumption of all types of fluids including tapwater, milk, soft drinks, alcoholic beverages, and water intrinsic to purchased foods.

Tracer-element studies - Soil ingestion studies that use trace elements found in soil and poorly metabolized in the human gut as indicators of soil intake.

Uncertainty - Uncertainty represents a lack of knowledge about factors affecting exposure or risk and can lead to inaccurate or biased estimates of exposure. The types of uncertainty include: scenario, parameter, and model.

Upper percentile - Values at the upper end of the distribution of values for a particular set of data.

Uptake - The process by which a substance crosses an absorption barrier and is absorbed into the body.

Variability - Variability arises from true heterogeneity across people, places or time and can affect the precision of exposure estimates and the degree to which they can be generalized. The types of variability include: spatial, temporal, and inter-individual.

Ventilation rate (VR) - Alternative term for inhalation rate or breathing rate. Usually measured as minute volume, i.e. volume (liters) of air exhaled per minute.

Volume of exhaled air (V_E) - Product of the number of respiratory cycles in a minute and the volume of air respired during each respiratory cycle (tidal volume, V_T).